What is claimed is:

1. An electronically self-addressable device, comprising:
a substrate;
an electrode, said electrode being supported by said substrate;
a current source operatively connected to said electrode; and
an attachment layer adjacent to said electrode, wherein said layer is permeable to a counterion but not permeable to a molecule capable of insulating or binding to said electrode and said layer is capable of attaching a macromolecule.

2. The electronic device of claim 1, further comprising a permeation layer, said permeation layer being disposed between said attachment layer and said electrode.

3. The electronic device of claim 1, wherein said current source comprises a direct current source.

4. The electronic device of claim 1, wherein said substrate comprises a member selected from a group consisting of silicon, glass, silicon dioxide, plastic, and ceramic.

5. The electronic device of claim 1, wherein said substrate comprises a base and an overlying insulator.

6. The electronic device of claim 5, wherein said base comprises a member selected from a group consisting of silicon, glass, silicon dioxide, plastic, and ceramic.

7. The electronic device of claim 5, wherein said base consists of silicon.

8. The electronic device of claim 5, wherein said insulator comprises silicon dioxide.

9. The electronic device of claim 1, wherein said substrate comprises a circuit pattern or circuit board.

10. The electronic device of claim 1, wherein said electrode is capable of moving a charged macromolecule to said attachment layer.

11. The electronic device of claim 1, wherein said electrode is capable of simultaneously moving a charged first macromolecule to said attachment layer and removing a second macromolecule having the opposite charge to said first macromolecule from said attachment layer.

12. The electronic device of claim 2, wherein said permeation layer comprises aminopropyltriethoxy silane.

13. The electronic device of claim 2, further comprising a buffer reservoir disposed between said permeation layer and said electrode.

14. The electronic device of claim 1, wherein the attachment of said macromolecule to said attachment layer does not insulate said electrode.

15. The electronic device of claim 1, wherein said electrode comprises a material selected from a group consisting of aluminum, gold, silver, tin, copper, platinum, palladium, carbon, and semiconductor materials.

16. The electronic device of claim 1, wherein the electrode comprises a material selected from a group consisting of aluminum, gold, silver, tin, copper, platinum, palladium, carbon, and semiconductor materials.

17. The electronic device of claim 1, wherein the attachment of a binding entity to said attachment layer does not insulate said electrode.

18. An electronically self-addressable device, comprising:

a substrate;

a plurality of electrodes, each said electrode being disposed upon said substrate;

a current source operatively connected to said plurality of electrodes; and

an attachment layer adjacent each said electrode, wherein said layer is permeable to a counterion but not permeable to a molecule capable of insulating or binding to each said electrode and said layer is capable of attaching a macromolecule.

19. The electronic device of claim 18, further comprising a switch controller which connects said current source to said plurality of electrodes.

20. The electronic device of claim 18, further comprising a permeation layer disposed between said attachment layer and each said electrode.

21. The electronic device of claim 18, wherein each said electrode comprises a material selected from a group consisting of aluminum, gold, silver, tin, copper, platinum, palladium, carbon, and semiconductor material.

22. The electronic device of claim 18, further comprising an electronic insulative material disposed between said plurality of electrodes.

23. The electronic device of claim 18, wherein said plurality of electrodes arranged in an array.

24. The electronic device of claims 18, further comprising a cavity for holding a solution comprising an entity selected from a group consisting of binding entities, reagents, and analytes.

25. The electronic device of claim 18, wherein specific binding entities have been selectively transported and bound to said plurality of addressable binding locations, forming an addressed active location device.

26. The electronic device of claim 18, wherein the width of the binding locations on the device is between 0.5 microns and 200 microns.

27. The electronic device of claim 18, wherein the width of the binding locations on the device is between 5 microns and 100 microns.

28. The electronic device of claim 18, wherein said plurality of binding locations is arranged in a two dimensional array.

29. The electronic device of claim 18, wherein said plurality of binding locations is arranged in a three dimensional array.

30. The electronic device of claim 18, further comprising a computation system, wherein said system is electronically connected to said plurality of binding locations.

31. The electronic device of claim 30, wherein said computation system is connected to said electrodes.

32. Method for electronically controlling nucleic acid hybridization, comprising the steps of:

providing a location connected to an electrical source;

contacting a first nucleic acid with a second nucleic acid, wherein said second nucleic acid is attached to said location; and

placing said location at a negative potential for a sufficient time, wherein said first nucleic acid is removed from said second nucleic acid if said first nucleic acid is a non-specific nucleic acid sequence to said second nucleic acid, but not removed if said first nucleic acid is a specific nucleic acid sequence to said second nucleic acid.

33. The method of claim 32, wherein both said first nucleic acid and said second nucleic acid are in a solution.

34. The method of claim 32, further comprising the step of placing said location at a positive potential before placing said location at a negative potential, thereby concentrating said first nucleic acid on said location.

35. The method of claim 32, wherein said negative potential is increased or decreased incrementally.

36. The method of claim 32, wherein said non-specific nucleic acid sequence has one mismatch with the sequence of said second nucleic acid.

37. The method of claim 32, wherein said first nucleic acid consists of no more than seven nucleotides.

38. The method of claim 32, wherein said first nucleic acid consists of no less than 22 nucleotides.

39. The method of claim 32, wherein said first nucleic acid consists of between 7 and 22 nucleotides.

40. The method of claim 32, wherein said first nucleic acid comprises a detectable element.

41. The method of claim 32, wherein said first nucleic acid comprises a fluorophore.

42. The method of claim 41, wherein said fluorophore is selected from a group consisting of Texas Red and fluorescein.

43. The method of claim 32, wherein said first nucleic acid comprises a deoxyribonucleotide.

44. The method of claim 32, wherein said first nucleic acid comprises a ribonucleotide.

45. The method of claim 32, wherein said first nucleic acid comprises a modified nucleotide.

46. The method of claim 33, further comprising the steps of:

adding a detectable dye in said solution, wherein said dye binds to double-stranded nucleic acid with higher affinity than single-stranded nucleic acid; and

determining the level of hybridization between said first nucleic acid and said second nucleic acid at said location by measuring the level of said dye at said location.

47. The method of claim 46, wherein said dye comprises ethidium bromide.

48. The method of claim 33, further comprising the steps of:

adding a detectable dye in said solution, wherein said dye gives a stronger detectable signal when in contact with a double-stranded nucleic acid than with a single-stranded nucleic acid; and

determining the level of hybridization between said first nucleic acid and said second nucleic acid at said location by measuring the level of said detectable signal of said dye at said location.

49. The method of claim 48, wherein said dye comprises ethidium bromide.

50. The method of claim 33, wherein said solution comprising a third nucleic acid consisting of a non-specific nucleic acid sequence to said second nucleic acid.

51. The method of claim 50, wherein the concentration of said third nucleic acid is more than 1,000 fold of the concentration of said first nucleic acid.

52. The method of claim 32, wherein said first nucleic acid consists of seven nucleotides.

53. The method of claim 32, wherein said first nucleic acid consists of between 5 and 7 nucleotides.

54. The method of claim 32, wherein said first nucleic acid consists of 22 nucleotides.

55. Method for electronically controlling nucleic acid hybridization, comprising the steps of:

providing a location connected to an electrical source;

contacting a plurality of nucleic acids with a target nucleic acid, wherein said target nucleic acid is attached to said location; and

placing said location at a negative potential for a sufficient time, wherein a non-specific nucleic acid sequence to said target nucleic acid but not a specific nucleic acid sequence from said plurality of nucleic acids is removed from said target nucleic acid.

56. Method for electronically concentrating an electrically charged entity in a solution at a location, comprising the steps of;

contacting said solution with a first location including a first underlying electrode, and a second location including a second underlying electrode; and

placing said first location at an opposite charge to said entity, relative to said second location, thereby concentrating said entity on said first location but not said second location.

57. The method of claim 56, further comprising the step of placing said second location at the same charge to said entity.

58. The method of claim 56, further comprising the step of forming a covalent bond between said entity and an attachment layer at said first location.

59. The method of claim 56, wherein said entity is a nucleic acid and said first location is charged with positive potential.

60. The method of claim 59, wherein said second location is charged with negative potential.

61. The method of claim 56, wherein the concentration of said entity at said first location is more than 10 times of that of said entity at said second location.

62. The method of claim 56, wherein the concentration of said entity at said first location is more than 1,000 times of that of said entity at said second location.

63. The method of claim 56, wherein the concentration of said entity at said first location is more than 10^6 times of that of said entity at said second location.

64. The method of claim 56, further comprising the step of attaching said entity to said first location.

65. Method for electronically transporting a charged entity in a solution from a first location to a second location, comprising the steps of:

contacting said solution with said first and second locations;

placing said first location at an opposite charge to said entity, relative to said second location, thereby transporting said entity to said first location; and

thereafter, placing said second location at an opposite charge to said entity, relatively to said first location, thereby transporting said nucleic acid from said first location to said second location.

66. The method of claim 65, wherein said entity is a nucleic acid.

67. The method of claim 65, further comprising the step of attaching said entity to said second location.

68. Method for electronically controlled synthesis of biopolymers on a plurality of locations, comprising the steps of:

providing a plurality of reaction locations on a substrate, wherein each reaction location is individually electronically addressable;

forming an attachment layer upon each reaction location;

contacting said plurality of reaction locations with a solution comprising a charged monomer-A;

selectively biasing a designated A location at which reaction A is to occur at an opposite charge to monomer-A, and biasing another location at which no reaction A is to occur the same charge as monomer-A, thereby concentrating and reacting monomer A on said A location;

thereafter, removing the unreacted monomer-A from said plurality of reaction locations;

contacting said plurality of reaction locations with a solution comprising a charged monomer-B;

selectively biasing said A location at the opposite charge of monomer-B, and biasing another location at which no reaction B is to occur the same charge as monomer-B, thereby concentrating and reacting monomer B on said A location to form dimer A-B.

69. The method of claim 68, wherein said monomer-A consists of a nucleotide and said monomer-B consists of a nucleotide.

70. The method of claim 68, wherein said monomer-A consists of an amino acid and said monomer-B consists of an amino acid.

71. Method for replicating a master self-addressable electronic device addressed with specific nucleic acid sequences, comprising the steps of:

providing complimentary sequences to said specific nucleic acid sequences and hybridizing said complimentary sequences to said specific nucleic acid sequences addressed on said master device;

aligning unaddressed locations on a recipient self-addressable electronic device with the addressed locations on said master device; and

biasing the locations on said master device negative and the locations on said recipient device positive, thereby transporting said complimentary sequences to said unaddressed locations on said recipient device.

72. The method for replicating patterned sequences of claim 71, further comprising the step of providing a positively charged chaotropic agent or denaturant of denature the complimentary sequences from the master template.

73. A self-addressable electronic device for genetic typing, comprising:

a plurality of electronically addressable locations each comprising an electrode; and

a binding entity attached to each of said plurality of locations, wherein each said entity is capable of detecting the presence of a genetic sequence.

74. The self-addressable electronic device of claim 73, wherein said genetic sequence is a nucleotide sequence.

75. The self-addressable electronic device of claim 74, wherein said nucleotide sequence is a cDNA sequence.

76. The self-addressable electronic device of claim 74, wherein said nucleotide sequence is a genomic DNA sequence.

77. The self-addressable electronic device of claim 74, wherein said nucleotide sequence is an mRNA sequence.

78. The self-addressable electronic device of claim 74, wherein said nucleotide sequence is a cRNA sequence.

79. The self-addressable electronic device of claim 73, wherein said genetic sequence is an amino acid sequence.

80. The self-addressable electronic device of claim 73, wherein each said binding entity attached to each said plurality of locations is the same.

81. The self-addressable electronic device of claim 73, wherein a said binding entity is different from another said binding entity.

82. Method for electronically controlled genetic typing, comprising the steps of:

providing a plurality of electronically addressable locations each comprising an electrode;

attaching a binding entity to each of said plurality of locations, wherein each said entity is capable of detecting the presence of a genetic sequence;

contacting a sample with said plurality of locations;

determining the genetic profile of said sample by detecting the presence or absence of said genetic sequence at each of said plurality of locations.

SUB B1

83. Method for electronically controlled enzymatic reaction at an addressable location, comprising the steps of:

providing an electronically addressable location comprising an electrode;

contacting a substrate with said location;

placing said location at an opposite charge to said substrate, thereby concentrating said substrate on said location;

attaching said substrate to said location;

contacting an enzyme with said location;

placing said location at an opposite charge to said enzyme, thereby concentrating said enzyme on said location; and

allowing said enzyme to react with said substrate on said location.

84. The method of claim 83, wherein said substrate comprises a nucleic acid.

SUB B2

85. The method of claim 83, wherein said enzyme comprises a restriction enzyme, a ligase, a proteinase, a glycosidase, or a phosphorylase.

86. The method of claim 83, wherein said enzyme comprises a DNA polymerase.

87. The method of claim 83, wherein said enzyme comprises an RNA polymerase.

88. The method of claim 83, wherein said enzymatic reaction comprises an enzymatic digestion of a nucleic acid.

89. The method of claim 83, wherein said enzymatic reaction comprises synthesis of a nucleic acid.

90. The method of claim 83, wherein said enzymatic reaction comprises synthesis of a polypeptide.

91. Method for electronically controlled amplification of nucleic acid, comprising the steps of:

(1) providing an electronically addressable location comprising an electrode;

(2) providing an oligonucleotide primer Y attached to said location;

(3) contacting a single stranded nucleic acid X with said location, wherein said primer Y specifically hybridizes to said nucleic acid X;

(4) placing said location at an opposite charge to said nucleic acid X, thereby concentrating said nucleic acid X on said location and hybridizing said nucleic acid X to said primer Y;

(5) contacting a nucleic acid polymerase with said location;

(6) placing said location at an opposite charge to said polymerase, thereby concentrating said polymerase on said location and allowing said polymerase to synthesize a nucleic acid Y from said primer Y on said location;

(7) placing said location at a negative potential for a sufficient time to remove said nucleic acid X from said location;

(8) contacting an oligonucleotide primer X with said location, wherein said primer X specifically hybridizes to said nucleic acid Y;

(9) placing said location at an opposite charge to said primer X, thereby concentrating said primer X on said location and hybridizing said primer X to said nucleic acid Y;

(10) placing said location at an opposite charge to said polymerase, thereby concentrating said polymerase on said location and allowing said polymerase to synthesize a nucleic acid from said primer X on said location.

92. Method for electronically controlling binding between macromolecules, comprising the steps of:

contacting a charged first macromolecule with a second macromolecule in a direct current electric field, wherein said second macromolecule is attached to a location;

placing said location at a potential opposite to the charge of said first macromolecule for a sufficient time, wherein said first macromolecule is removed from said second molecule if said first macromolecule does not specifically bind to said second macromolecule, but not removed if said first macromolecule specifically binds to said second macromolecule.

93. The method of claim 92, wherein said first macromolecule is a polypeptide.

94. The method of claim 92, wherein said first macromolecule is a nucleic acid.

Cold B3